Project Title: Mechanism-Based Testing Methodology For Improving the Oxidation, Hot Corrosion and Impact Resistance of High-Temperature Coatings for Advanced Gas Turbines

Planned NGT Project

Principal Investigators: F. S. Pettit (pettit@engrng.pitt.edu)
G. H. Meier (ghmeier@engrng.pitt.edu)

Department of Materials Science and Engineering
848 Benedum Hall
University of Pittsburgh
Pittsburgh, PA 15261

Subcontract Inf: Department of Mechanical Engineering
Carnegie mellon University
5000 Forbes Avenue
Pittsburgh, PA 15213-3890
Jack L. Beuth (beuth@andrew.cmu.edu)

ABSTRACT

In the next generation gas turbine, resistance to thermal cycling damage may be as important as resistance to long isothermal exposures. Moreover, metallic coatings and Thermal barrier Coatings (TBCs) may encounter attack by deposits arising from combustion of low-grade fuel and air borne impurities. Finally, there is currently a need for nondestructive techniques to assess metallic coating and TBC degradation and damage as a result of exposure to cyclic oxidation and hot corrosion conditions as well as foreign object-impact damage. The focus of this program is the development of a mechanism-based testing methodology for improving the oxidation, hot corrosion and impact resistance of high temperature metallic coatings and TBCs. This testing methodology involves a significant number of nondestructive tests directed at assessing coatings degradation and damage accumulation.

The University of Pittsburgh and Carnegie Mellon University are partnering with industry and several national laboratories in this effort. Metallic coatings on superalloys will be prepared by Praxair Surface technologies and Howmet Inc. The coatings will be tested and microstructurally characterized at the University of Pittsburgh and Carnegie Mellon University. Nondestructive testing of exposed specimens will be performed at Oak Ridge National Laboratory (ORNL) and Argonne National Laboratory (ANL) as well as the University of Pittsburgh. Finally, the National Institute of Standards and Technology (NIST) will attempt to model the degradation processes of some of the coatings based upon the mechanisms that have been formulated to develop life prediction models.